

DESCRIPTION

SPEAKER

This application is a U.S. national phase application of PCT
5 International Application PCT/JP2006/303024.

TECHNICAL FIELD

The present invention relates to a speaker for use in various
types of electronic equipment.

10

BACKGROUND ART

Conventional speakers generally have the following structures.
One of the conventional speakers includes a frame, a magnetic circuit, a
voice coil, a diaphragm, and a damper. The frame has a cylindrical
15 shape with a bottom face and an open top. The magnetic circuit is
placed on the inner bottom face of the frame. A coil portion of the voice
coil is disposed in a magnetic gap of this magnetic circuit. The
diaphragm is disposed in the opening of the frame, so that the inner
periphery thereof is fixed to the voice coil and the outer periphery
20 thereof is fixed to the frame via an edge. The damper is fixed to the
voice coil at one end thereof, and to the frame at the other end thereof.
A speaker with this conventional structure is disclosed in Fig. 8 of
Japanese Patent Unexamined Publication No. H11-150791.

However, the conventional speaker has an edge along the outer
25 periphery of the diaphragm, and the damper is fixed to the voice coil,
which is fixed to the diaphragm. In these types of speakers, the load
imposed from the edge and damper in the upward and downward
directions when the diaphragm moves vertically is not substantially

constant. As a result, distortions can occur in the reproduction of sounds. Additionally, because both the edge and damper are fixed to the frame, downsizing of the speaker is generally difficult.

5 SUMMARY OF THE INVENTION

The present invention provides a speaker that prevents occurrence of distortions when the diaphragm vertically moves in sound reproduction. Additionally, the present invention provides a speaker that can be downsized.

10 A speaker of the present invention includes a frame, a magnetic circuit, a voice coil, a diaphragm, and a support. The frame has a cylindrical shape with a bottom face and an open top. The magnetic circuit is placed on the inner bottom face of the frame. A coil portion of the voice coil is disposed in a magnetic gap of this magnetic circuit.

15 The diaphragm is disposed in an opening of the frame so that the inner periphery thereof is fixed to the voice coil and the outer periphery thereof is fixed to the frame via a first edge. The support is fixed to the diaphragm on the magnetic circuit side at one end of the support, and to the vicinity of the magnetic circuit via a second edge at the other

20 end. The first edge is substantially analogous to the second edge in shape with respect to the boundary between the first and second edges.

With this structure that has no damper and has the diaphragm supported near the magnetic circuit via a support, the first edge along the outer periphery of the diaphragm is substantially analogous in

25 shape to the second edge at the other end of the support, with respect to the boundary between the first and second edges. For this reason, the load imposed when the diaphragm vertically moves is substantially constant, and thus distortions in sound reproduction are unlikely to

occur. Further, the second edge at the other end of the support is fixed to the vicinity of the magnetic circuit. This structure allows downsizing more easily than fixing the second edge to the frame.

5 BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a sectional view illustrating a structure of a speaker in accordance with a first exemplary embodiment of the present invention.

Fig. 2 shows characteristics of harmonic distortion factors of the speaker in accordance with the exemplary embodiment.

10 Fig. 3 is a sectional view illustrating a structure of a speaker in accordance with a second exemplary embodiment of the present invention.

Fig. 4 is a sectional view illustrating a structure of a speaker in accordance with a third exemplary embodiment of the present
15 invention.

REFERENCE MARKS IN THE DRAWINGS

1	Frame
2	Magnetic circuit
20 3	Magnetic gap
4	Coil portion
5	Voice coil
6	First edge
7	Diaphragm
25 8	Support
9	Second edge
10	Yoke
11	Magnet

12 Plate
13, 14 Fixed part

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

5 Hereinafter, a description is provided of exemplary embodiments of the present invention with reference to the accompanying drawings.

FIRST EXEMPLARY EMBODIMENT

Fig. 1 is a sectional view illustrating a structure of a speaker in
10 accordance with the first exemplary embodiment of the present invention. Fig. 2 shows characteristics of harmonic distortion factors of the speaker of the exemplary embodiment. In Fig. 1, the speaker includes frame 1, magnetic circuit 2, voice coil 5, diaphragm 7, and support 8. Frame 1 has a cylindrical shape with a bottom face and an
15 open top (shaped like a bowl). Magnetic circuit 2 is disposed on the inner bottom face of frame 1.

Voice coil 5 has a cylindrical shape so that coil portion 4 thereof is disposed in magnetic gap 3 of magnetic circuit 2. Diaphragm 7 is disposed in the opening of frame 1. The diaphragm has an internal
20 and an external side and a donut shape so that the inner periphery thereof is fixed to voice coil 5, and the outer periphery thereof is fixed to frame 1 via first edge 6. Support 8 is fixed to diaphragm 7 on the side of magnetic circuit 2 (i.e., the internal side of the diaphragm) at one end of the support, and to the upper end of yoke 10 of magnetic circuit 2 via
25 second edge 9 at the other end. Magnetic circuit 2 is made of yoke 10, magnetic circuit 11, and plate 12.

Both of first edge 6 and second edge 9 are formed of a rubber material. With reference to Fig. 1, first edge 6 has an

upwardly-projecting circular section, and second edge 9 has a downwardly-projecting circular section. First edge 6 is substantially analogous to second edge 9 in shape with respect to the boundary therebetween (i.e., first edge 6 and second edge 9 have substantially the same shape). First edge 6 can be formed to have a downwardly-projecting circular section, and second edge 9 can be formed to have an upwardly-projecting circular section, in Fig. 1.

When sound electric signals are passed through coil portion 4 of voice coil 5 in the above structure, the influence of the magnetic flux in magnetic gap 3 allows voice coil 5 to vertically move diaphragm 7. Thus, sounds are reproduced. At this time, as described above, both of first edge 6 and second edge 9 are made of the same material, e. g. rubber materials. First edge 6 has an upwardly-projecting circular section, and second edge 9 has a downwardly-projecting circular section.

With this structure, first edge 6 is substantially analogous to second edge 9 in shape with respect to the boundary therebetween, and first edge 6 and second edge 9 are made of the same material. For this reason, the load imposed when diaphragm 7 vertically moves is the same even in the upward motion and downward motion of diaphragm 7. As a result, distortions are unlikely to be caused by asymmetrical upward and downward motions in sound reproduction.

As shown by "conventional speaker" in Fig. 2, the load imposed by the edge and damper of the conventional speaker when the diaphragm vertically moves is not substantially constant in the upward and downward directions. As a result, particularly at low frequencies, large distortions occur. In contrast, for a speaker of this exemplary embodiment, as similarly shown by "speaker of the present invention",

the load imposed when diaphragm 7 vertically moves is the same in the upward and downward motions of diaphragm 7. Thus, it can be understood that even at low frequencies, occurrence of harmonic distortions are considerably reduced in comparison with the
5 conventional speaker.

If second edge 9 at the other end of support 8 is fixed to frame 1 on the outer peripheral side of magnetic circuit 2 like the conventional structure, the frame must be enlarged so that the second edge is movable. However, because second edge 9 at the other end of support
10 8 is fixed to the end of yoke 10 in this exemplary embodiment, a movable range of second edge 9 is sufficiently ensured on the outer peripheral side of yoke 10 even without frame 1 enlarged. As a result, the speaker can easily be downsized.

15 SECOND EXEMPLARY EMBODIMENT

Fig. 3 is a sectional view illustrating a structure of a speaker in accordance with the second exemplary embodiment of the present invention. In Fig. 3, the same elements used in Fig. 1 are denoted with the same reference marks and descriptions thereof are omitted.
20 The speaker of this exemplary embodiment includes cylindrical fixed part 13 along the outer periphery of yoke 10. Second edge 9 is fixed to the upper end of fixed part 13. This structure may prevent the inflow of an adhesive into magnetic gap 3 when second edge 9 is bonded with the adhesive, and ensure the distance from the second edge to magnetic
25 gap 3 and a bonding space at the same time.

As described above, similar to the first exemplary embodiment, first edge 6 is substantially analogous to second edge 9 in shape with respect to the boundary therebetween. Thus, the load imposed when

diaphragm 7 vertically moves is the same in the upward and downward motions of diaphragm 7. As a result, distortions are unlikely to occur in sound reproduction. As for the harmonic distortion factors of this embodiment, substantially similar characteristics to those of the first
5 exemplary embodiment shown in Fig. 2 can be obtained. Further, because second edge 9 at the other end of support 8 is fixed to fixed part 13 provided along the outer periphery of yoke 10, a movable range of second edge 9 is sufficiently ensured on the outer peripheral side of fixed part 13 even without the frame enlarged. As a result, the
10 speaker can easily be downsized.

Similarly to a third exemplary embodiment, which will be described later, when the distance from the bottom face of frame 1 to the side end face of second edge 9 of fixed part 13 is smaller than the distance from the bottom face to the end of yoke 10 constituting
15 magnetic circuit 2, the inflow of the adhesive into magnetic gap 3 can be more easily prevented.

THIRD EXEMPLARY EMBODIMENT

Fig. 4 is a sectional view illustrating a structure of a speaker in
20 accordance with the third exemplary embodiment of the present invention. In Fig. 4, the same elements used in Fig. 1 are denoted with the same reference marks and descriptions thereof are omitted. The speaker of this exemplary embodiment includes cylindrical fixed part 14 integral with frame 1 along the outer periphery of yoke 10, and
25 second edge 9 is fixed to the upper end of fixed part 14. The distance from the bottom face of frame 1 to the side end face of second edge 9 of fixed part 14 is smaller than the distance from the bottom face to the end of yoke 10 constituting magnetic circuit 2. In other words, the

height of fixed part 14 is smaller than the end of yoke 10 in the direction toward the bottom face of frame 1.

With this structure, the height of fixed part 14 to which second edge 9 is bonded is smaller than the height of yoke 10. This structure
5 allows prevention or reduction of the inflow of an adhesive into magnetic gap 3 when second edge 9 is bonded with the adhesive, and ensures the distance from the second edge to magnetic gap 3 is maintained, along with an adhesive space. Further, this embodiment has an advantage of reducing the number of components and costs, in
10 comparison with the second exemplary embodiment. The height of fixed part 13 of the second exemplary embodiment can be reduced similarly to the fixed part of the third exemplary embodiment.

As described above, similarly to the first and second exemplary embodiments, first edge 6 is substantially analogous to second edge 9 in
15 shape with respect to the boundary therebetween. Thus, the load imposed when diaphragm 7 vertically moves is the same in the upward and downward motions of diaphragm 7. As a result, distortions are unlikely to occur in sound reproduction. As for the harmonic distortion factors of this embodiment, substantially similar
20 characteristics to those of the first exemplary embodiment shown in Fig. 2 can be obtained. Further, because second edge 9 at the other end of support 8 is fixed to fixed part 14 provided along the outer periphery of yoke 10, a movable range of second edge 9 is sufficiently ensured on the outer peripheral side of fixed part 14 even without the frame enlarged.
25 As a result, the speaker can easily be downsized.

INDUSTRIAL APPLICABILITY

As described above, a speaker of the present invention is unlikely

to cause distortions when a diaphragm thereof vertically moves in sound reproduction and can be downsized. Thus, the invention is useful as a speaker, for example, for use in various kinds of electronic equipment.